1989–1991

ANNUAL SURVEY REPORT

U.S. Pharmaceutical Industry

Pharmaceutical Manufacturers Association

ANNUAL SURVEY REPORT

PMA 1989–1991

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Foreword

The Pharmaceutical Manufacturers Association (PMA) is a non-profit trade association of over 100 research-based pharmaceutical companies. These firms produce most of the ethical pharmaceuticals sold in the United States and a substantial portion of the world supply.

The Annual Survey is designed to provide information on the ethical pharmaceutical industry to business executives, financial analysts, educators, and other interested groups.

Survey questions are updated periodically and the scope of the survey expanded or reduced to reflect changing priorities. However, an effort is made to maintain continuity and comparisons with earlier surveys can be made in most categories.

Responses to surveys are reasonably uniform and consistent, but there are minor variations, from year to year. To compensate for these, adjustments are made based on supplementary data available to PMA from other sources. No adjustment has been made for inflation; data are presented in current dollars for manufacturers' sales and R&D expenditures.

Although this is a membership survey, selected operational totals include estimates for nonmember firms based on data obtained from other sources. For example, aggregate human-dosage form drug sales have been extrapolated to represent the entire industry. However, extrapolation was not possible for bulk sales, veterinary use pharmaceuticals, foreign data or R&D. In order to maintain continuity of the data, some firms who are no longer PMA member firms are represented by estimate in the data for PMA members.

TRENDS

1989–1991[a] Pharmaceutical Industry Operations PMA Member Firms

Global sales in 1990 were estimated to exceed $56 billion, nearly three times higher than sales ten years ago. Global R&D expenditures exceeded $8 billion for the first time and have more than quadrupled since 1979. The trends for 1989–1991 are shown below.

- Global Sales, Ethical Pharmaceuticals, Human and Veterinary Use:
  1989 $50.1 billion, up 6.8% from 1988
  1990 $56.2 billion, up 12.2% from 1989
  1991 $63.0 billion, up 12.1% from 1990

- U.S. Sales[b], Human-Use, Dosage-Form Pharmaceuticals:
  1989 $35.6 billion, up 14.1% from 1988
  1990 $39.3 billion, up 10.4% from 1989
  1991 $43.5 billion, up 10.7% from 1990

- Global R&D Expenditures for Human and Veterinary Use Pharmaceuticals:
  1989 $7.3 billion, up 12.3% from 1988
  1990 $8.1 billion, up 11.0% from 1989
  1991 $9.2 billion, up 13.6% from 1990

Table 1

[a] Figures for 1990–91 are budgeted or estimated figures.

[b] U.S. sales figures apply to all U.S. firms, not PMA member firms only.

U.S. Pharmaceutical Industry Sales & R&D Expenditures, 1965-1991[a] (millions of dollars) 1

Year	U.S. Sales[b]	Global Sales and R&D-PMA Member Firms		
		Sales		R&D[d]
		Human and Veterinary[c]		
	Human Dosage	*Dosage Only*	*Dosage & Bulk*	*Human & Veterinary*
1991[e]	43,493	62,509	62,971	9,196
1990[e]	39,344	55,807	56,161	8,132
1989	35,641	49,828	50,139	7,330
1988	31,224	45,088	46,973	6,537
1987	28,288	40,111	41,635	5,505
1986	25,227	35,685	37,137	4,740
1985	22,065	30,698	32,026	4,078
1984	19,345	28,615	29,854	3,579
1983	17,278	26,254	27,506	3,218
1982	15,394	24,466	25,654	2,774
1981	13,000	22,378	23,530	2,340
1980	11,799	21,460	22,513	1,977[f]
1979	10,044	17,789	18,939	1,627
1978	9,156	15,463	16,431	1,404
1977	8,233	13,377	14,155	1,276
1976	7,669	12,295	13,035	1,164
1975	6,895	11,129	11,769	1,062
1974	6,083	9,755	10,361	942
1973	5,507	8,403	8,839	825
1972	5,018	7,576	7,930	726
1971	4,667	6,787	7,605	684
1970	4,322	6,226	6,637	619
1969	4,008	5,632	6,008	550
1968	3,655	5,097	5,482	495
1967	3,226	4,546	4,941	461
1966	3,011	4,105	4,509	416
1965	2,779	3,758	4,136	365

[a] Additional data are available to 1954. See earlier Annual Survey Reports.

[b] U.S. Sales of finished prescription and "otc ethical" dosage forms.

[c] Global sales are defined to include total ethical pharmaceutical sales within the United States, exports to nonaffiliated firms and sales abroad of U.S. affiliates. Figures apply to PMA member companies only. Historical series has been adjusted accordingly.

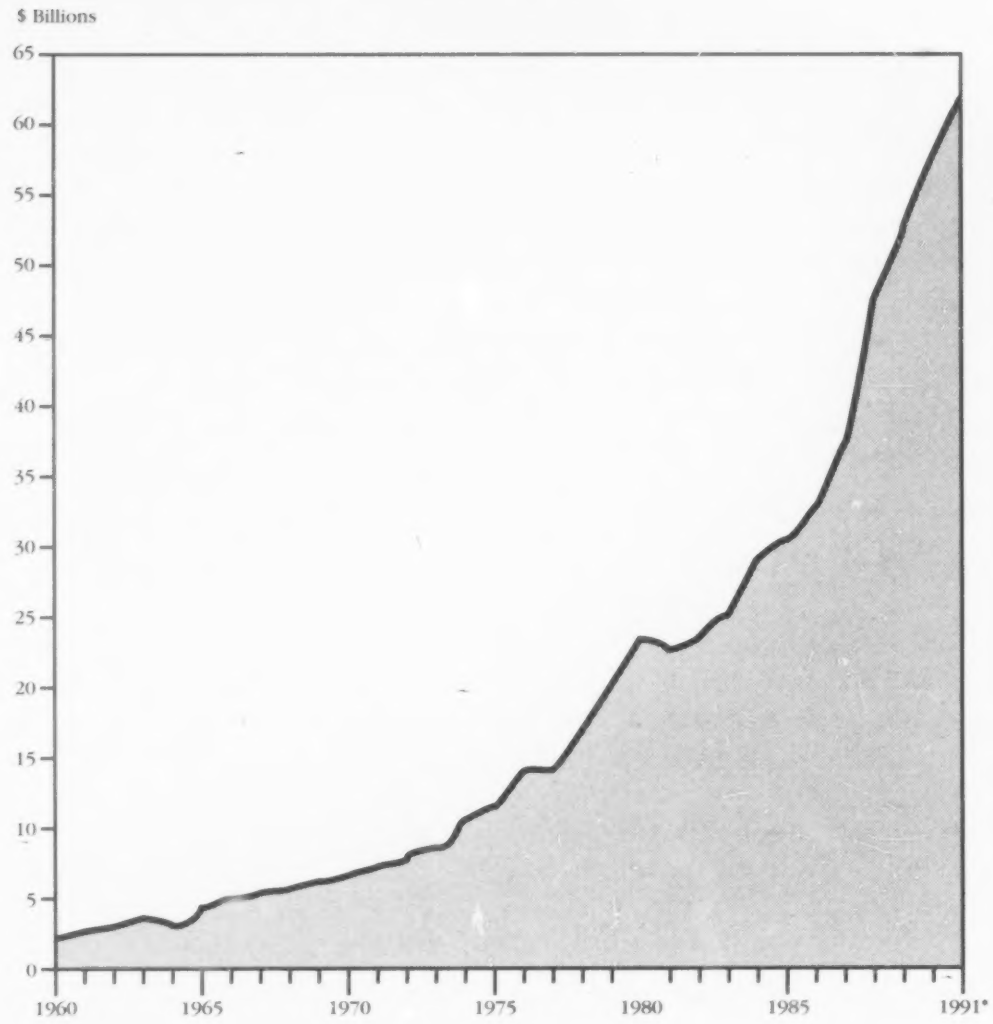
[d] Global R&D includes all ethical pharmaceutical research and development financed or conducted by U.S. pharmaceutical companies in the U.S. and abroad, and in the U.S. only by U.S. based subsidiaries of foreign-owned firms.

[e] PMA estimates based on member company budgeted figures or estimates.

[f] R&D figures for 1979 and 1980 reflect a 21% increase in expenditures; however, part of this increase is due to improved reporting of expenditures in foreign countries. Adjusting for this improved reporting results in an 18% increase.

Source: PMA Annual Survey Report

SALES



Projected*

SALES[a]

Highlights

U.S. sales increased 13.6% in 1989 and 10.4% in 1990—sales are predicted to increase 10.5% in 1991. Foreign sales decreased by 4.7% in 1989. Sales of prescription legend products represent over 90% of the ethical market in the U.S. European countries receive over 50% of sales abroad; the Pacific and Far East nations represent almost one fourth of sales in 1989. The leading selling product class in the U.S. is cardiovascular products; anti-infectives are the leading sellers abroad. In the U.S. market, more than 70% of manufacturers' sales are distributed through wholesalers.

1988–1991 Sales in the United States and Abroad

- U.S. sales volume rose 13.6% in 1989, an estimated 10.4% in 1990, and was projected to increase by 10.5% in 1991; foreign sales volume decreased by 4.7% in 1989, increased an estimated 15.2% in 1990, and a projected 15.1% in 1991.

- U.S. sales accounted for 66% of volume for U.S. manufacturers in 1989, 65% in 1990 and 65% in 1991.

- Exports amounted to $3,146 million in 1989, up 16.7% from 1988.

Tables 2 and 3.

Ethical Pharmaceuticals Sales Growth, (millions of dollars) 2

Year	Domestic Sales	Percent Change	Foreign Sales	Percent Change	Total	Percent Change
1988	$29,324.6	+10.4%	$17,649.3	+17.1%	$46,973.9	+12.8%
1989	$33,321.6	+13.6%	$16,817.9	- 4.7%	$50,139.5	+6.7%
1990	$36,785.3	+10.4%	$19,375.3	+15.2%	$56,160.6	+12.0%
1991	$40,664.4	+10.5%	$22,306.5	+15.1%	$62,970.9	+12.1%

[a] Sales for PMA member firms only.

1989 Domestic Sales of Dosage Form Products

- Prescription drugs accounted for 90% of U.S. sales in the human use, dosage form category; over-the-counter ethical products accounted for 4% and the remainder came from sales of biologicals, diagnostics and other products.

- Government purchases of ethical pharmaceuticals constituted 6% of the total; 80% of these purchases were prescription drugs.

Domestic Sales of Dosage-Form, Human-Use Ethical Pharmaceuticals, 1989 (millions of dollars) 4

Dosage Form Human Use	To Private Sector	To Government	Total Domestic Sales
Prescription Legend[a]	$30,498.9	$1,623.9	$32,122.8 (90.1%)
Over-the-Counter Ethical[b]	1,312.5	33.2	1,345.7 (3.8%)
Biologicals[c]	1,010.8	262.0	1,272.8 (3.6%)
Diagnostic Products[d]	732.9	102.1	835.0 (2.3%)
Other	58.6	6.0	64.6 (.2%)
Total, Dosage Form, Human Use	$33,613.7	$2,027.2	$35,640.9 (100%)

[a] Prescription Legend—A drug product which by federal law is available only by prescription from a licensed physician.

[b] Over-the-Counter Ethical—A drug product sold over the counter but primarily promoted to the professions. This does not include proprietary drugs (i.e., OTC products on display for purchase by customers).

[c] Biologicals—Bacterial and virus vaccine, antigens, antitoxins, toxoids, and analogous products (such as allergenic extracts) serums, plasmas, and other blood derivatives for human use.

[d] Dosage form, diagnostic agents for in-vivo use.

1989 Sales by Geographic Area

- Europe accounted for 53% of foreign sales; Japan, Australia and New Zealand 18%; Latin America 9%.

Distribution of Foreign Sales* by Geographic Area, 1988 and 1989

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Area	Percentage of Total Foreign Sales	
	1988	1989
Canada	10.3%	10.8%
Latin America (Central America, South America, excluding Cuba)	10.9	9.2
Western Europe (excluding Turkey, Yugoslavia and Albania; including Greece and Scandinavia)	50.9	53.1
Middle East	2.0	1.7
Africa	3.0	2.1
Far East Pacific (from Pakistan to Pacific Islands)	4.4	4.5
Japan, Australia, New Zealand	18.0	17.9
Socialist Bloc (Eastern Europe, USSR, Yugoslavia, Albania, Cuba, Peoples' Republic of China, N. Korea, Laos, Cambodia and Vietnam	.5	.7
Total	100.0%	100.0%

*Sales made abroad and exports to third parties.

1988 and 1989 Sales by Class of Customer

- Sales to wholesalers continued to increase.
- Total hospital sales declined from 10.6 to 10.2%.
- From 1979 to 1989 the wholesalers' percentage share of sales increased by nearly 40 percent.

Tables 6 and 7

Manufacturers Sales of Human-Use, Dosage-Form Products, in the United States, 1988, 1989 (millions of dollars)

6

Class of Customer	Sales 1988	Market Share 1988	Market Sales 1989	Share 1989
Wholesalers	$22,231.8	71.2%	$25,412.0	71.3%
Retailers	4,652.5	14.9	5,524.3	15.5
Private Hospitals	1,904.7	6.1	2,102.8	5.9
State and Local Government Hospitals	655.7	2.1	677.2	1.9
Federal Hospitals	749.4	2.4	855.4	2.4
Other Federal Government	343.5	1.1	392.0	1.1
Practitioners	374.7	1.2	427.7	1.2
Manufacturers, Repackagers and Other Direct Sales	312.2	1.0	249.5	.7
TOTAL	$31,224.5	100.0%	$35,640.9	100.0%

Ethical Pharmaceutical Manufacturers' Direct Human-Use Dosage-Form Sales in the United States by Class of Customer, 1979-1989 (odd years, percentage share of sales)

7

Class of Customer	1979	1981	1983	1985	1987	1989
Wholesalers	53.0%	59.2%	61.7%	67.3%	68.8%	71.3%
Retailers	22.5	18.0	17.2	16.0	15.9	15.5
Private Hospitals	14.9	13.9	12.6	8.8	7.4	5.9
State and Local Government Hospitals	4.0	3.9	3.5	2.5	2.1	1.9
Federal Hospitals	2.3	2.6	2.5	2.1	2.4	2.4
Other Federal Government	1.4	.9	1.2	1.6	1.3	1.1
Practitioners	1.2	.9	.7	.7	1.1	1.2
Manufacturers, Repackagers, and Other Direct Sales	.7	.6	.6	1.0	1.0	.7
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

1989 Sales by Product Class

- Products acting on the cardiovascular system remained the largest product sales category, accounting for 23% of domestic dosage form sales in 1989.

- Other product classes, in order of U.S. sales rank in 1989, were central nervous system (21%), anti-infectives (16%), neoplasms and endocrine (13%), and gastrointestinal and genitourinary (13%).

- In foreign sales, anti-infectives are first, followed by cardiovasculars and central nervous system. These three groups accounted for over half of the sales abroad.

Tables 8 and 9

Foreign Sales by Product Class, Dosage-Form Ethical Drugs for Human-Use, 1989 (millions of dollars) 9

Product Class	1989	Percent
Anti-Infectives	$ 3,355.2	22.4%
Central Nervous System	2,291.7	15.3
Respiratory System	659.1	4.4
Gastrointestinal and Genitourinary	1,048.5	7.0
Neoplasms and Endocrine	2,007.1	13.4
Cardiovasculars	3,115.5	20.8
Vitamins and Nutrients	479.3	3.2
Dermatologicals	808.8	5.4
Biologicals	224.8	1.5
Diagnostic Agents	104.8	.7
Other Pharmaceutical Preparations	883.7	5.9
TOTAL	$14,978.5	100.0%

Industry Employment

- PMA member companies employed an estimated 340,850 persons worldwide in pharmaceutical operations in 1989.
- 46% were employed abroad.
- 33% of all U.S. employees were in production, 31% in marketing, and 22% in medical R&D.

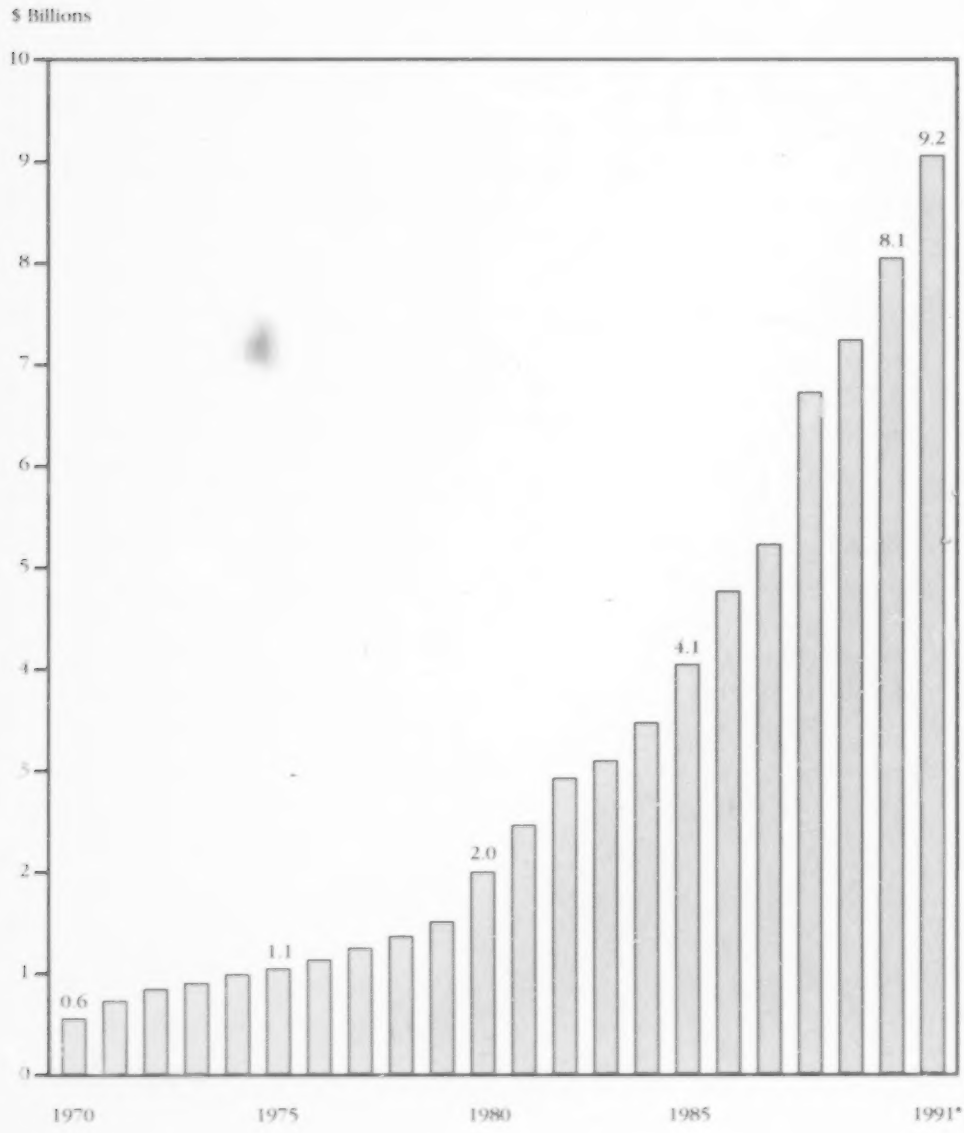
Domestic & Foreign Employment, Ethical Pharmaceuticals, in 1989 — 10

	1989
U.S. Employment	185,900
Production Workers	60,300
Marketing	55,500
Medical Research and Development	43,620
Administrative	19,410
Distribution & Others	7,070
Foreign Employment	154,950
TOTAL	340,850

Employment Abroad by Geographic Area, 1989 — 11

Area	
Canada	8,610
Latin America (Central America, South America, excluding Cuba)	28,430
Western Europe (excluding Turkey, Yugoslavia and Albania; including Greece and Scandinavia)	75,090
Middle East	2,560
Africa	3,670
Far East Pacific (from Pakistan to Pacific Islands)	18,090
Japan, Australia, New Zealand	17,800
Socialist Bloc (Eastern Europe, USSR, Yugoslavia, Albania, Cuba, Peoples' Republic of China, N. Korea, Laos, Cambodia and Vietnam)	700
Total	154,950

R&D



*Projected

R&D

Highlights

PMA members' continuing commitment to R&D is estimated at over $8.1 billion in 1990 and more than 80% of this spending is in the U.S. Manufacturers are devoting the largest percentage of R&D funds, both here and abroad, to research on cardiovascular products. R&D expenditures in the U.S. represent over 16% of total U.S. sales.

1988–1991 Research and Development

- Total R&D expenditures in 1989 reached $7.3 billion, up 12% from 1988. Expenditures for 1990 were budgeted at $8.1 billion and are expected to exceed $9 billion in 1991.
- 97% of company R&D funds were spent on human-use pharmaceuticals, and 3% on animal-use products.
- Government contracts increased from $2.1 million in 1989 to $2.9 million in 1990. $3.0 million is projectedd for 1991.

Table 12

Ethical Pharmaceutical Sales of PMA Member Firms, Domestic and Foreign: Shares of End-Use Totals, 1989 (millions of dollars)

3

	Domestic U.S. Sales			Foreign Sales				
	To Private Sector	To Government	Total Domestic Sales	Exports to Other Firms	Sales Abroad	Total Foreign Sales	Total	Sales for Export Intra-Firm Trans-Actions
Dosage Form	$30,178.4	$1,820.0	$31,998.4	$535.0	$14,443.5	$14,978.5	$46,976.9	$1,064.0
Human Use	(64.2%)	(3.9%)	(68.1%)	(1.1%)	(30.8%)	(31.9%)	(100.0%)	
Dosage Form	730.2	3.9	734.1	31.8	758.9	790.7	1,524.8	426.9
Veterinary Use	(47.9%)	(.2%)	(48.1%)	(2.1%)	(49.8%)	(51.9%)	(100.0%)	
Bulk	209.6	.3	209.9	214.5	556.7	771.2	981.1	753.9
Human Use	(21.4%)		(21.4%)	(21.9%)	(56.7%)	(78.6%)	(100.0%)	
Bulk	379.2		379.2	55.6	221.9	277.5	656.7	64.1
Veterinary Use	(57.7%)		(57.7%)	(8.5%)	(33.8%)	(42.3%)	(100.0%)	
TOTAL	$31,497.4	$1,824.2	$33,321.6	$836.9	$15,981.0	$16,817.9	$50,139.5 (100.00%)	$2,308.9

[a] Sales are before deducting cash discounts and other marketing expenses, but after returns and allowances (domestic returns and allowances totalled $1,018 million).

[b] Export sales are f.o.b. U.S. port. Domestic sales figures are f.o.b. plant or warehouse. In addition, transportation costs for domestic sales were $202 million and net value of discounts on domestic sales $615 million.

[c] Sales for Export Intra-Firm Transactions are Sales Abroad. Addition of the two export columns will provide aggregate ethical pharmaceutical exports.

Domestic Sales by Product Class, Dosage-Form Ethical Drugs for Human Use, 1989 (millions of dollars)

8

Product Class	Prescription Drugs		Over-the-Counter Ethicals		Total	
	Sales	Market Share	Sales	Market Share	Sales	Market Share
Central Nervous System	$6,970.7	21.7%	$176.3	13.1%	$7,147.0	21.4%
Anti-Infectives	5,171.8	16.1	65.9	4.9	5,237.7	15.6
Gastrointestinal & Genitourinary	4,143.8	12.9	380.8	28.3	4,524.6	13.5
Neoplasms and Endocrine	4,433.0	13.8	28.3	2.1	4,461.3	13.3
Vitamins and Nutrients	738.8	2.3	234.2	17.4	973.0	2.9
Cardiovasculars	7,516.7	23.4	0	0	7,516.7	22.5
Respiratory System	2,216.5	6.9	294.7	21.9	2,511.2	7.5
Dermatologicals	610.3	1.9	158.8	11.8	769.1	2.3
Other	321.2	1.0	6.7	.5	327.9	1.0
TOTAL	$32,122.8	100.0%	$1,345.7	100.0%	$33,468.5	100.0%

Capital Expenditures

Capital expenditures, which are expenditures in addition to actual research, were $1.1 billion in 1989. They are budgeted at $1.6 billion for 1990 and estimated at $2.2 billion in 1991.

Table 13

13

CAPITAL EXPENDITURES*
1989–1991

1989 Actual	1990 Budgeted	1991 Estimated
$1,055,754	$1,588,262	$2,186,045

*Expenditures for 31 respondents. No estimation has been done for nonrespondents.

1989–1991 Research and Development Expenditures Abroad

- R&D spending abroad by PMA members increased more than 15% in 1989. The share of total R&D spending performed abroad was 19% in 1988 and 18% in 1989. 18.0% was budgeted for 1990.

Tables 14 and 15

1988-1991 Research and Development Distribution of Expenditures

- The share of expenditures devoted to human-use drug research continued to increase slightly. Human-use drug research accounted for 96.7% of total expenditures in 1989, 96.9% in 1990 (budgeted), and 96.9% in 1991 (projected).

- The share of expenditures for intramural research in the United States for human-use drugs, about two-thirds of the total, showed a slight decrease in 1990 of about −.5%.

Table 16

Research by Geographic Area, 1988, 1989

- 68% of the research funds spent abroad were spent in Western Europe in 1989. In 1988 the figure was 72%.
- Japan, Australia and New Zealand accounted for 19% of foreign expenditures, Canada for 10% and Latin America for 2%.

Table 17

Distribution of R&D Expenditures Abroad by Geographic Area, 1988, 1989

17

Area	Percentage of Total 1988	1989
Canada	6.3%	10.4%
Latin America (Central America, South America, Caribbean, excluding Cuba)	1.5	1.6
Western Europe (excluding Turkey, Yugoslavia and Albania; including Greece and Scandinavia)	72.0	67.7
Middle East	.1	.2
Africa	.5	.3
Far East and Pacific (from Pakistan to Pacific Islands)	.3	.5
Japan, Australia and New Zealand	19.2	19.2
Socialist Bloc (including Eastern Europe, U.S.S.R., Yugoslavia, Albania, People's Republic of China, Laos, Cambodia and Vietnam)	.1	.1
TOTAL	100.0%	100.0%

Research and Development Allocation of Expenditures to New Product Research

- 83% of R&D funds are spent for research and development of new products; 17% goes for improvement of existing products.
- Abroad, the ratio of new product/existing product expenditures is 77/23.

Tables 18 and 19

Company-Financed R&D Expenditures in the United States 1989 (percentages) 18

	Human-and Veterinary-Use R&D 1989
Research for the Advancement of Scientific Knowledge and Development of New Products and Related Services	83.0%
Research Oriented to Significant Improvements and/or Modification of Existing Products	17.0%
TOTAL	100.0%

Company-Financed R&D Expenditures in Foreign Countries, 1989 (percentages) 19

	Human-and Veterinary-Use R&D 1989
Research for the Advancement of Scientific Knowledge and Development of New Products and Related Services	77.0%
Research Oriented to Significant Improvement and/or Modification of Existing Products	23.0%
TOTAL	100.0%

1988, 1989 Research and Development Allocation of Expenditures by Product Class

- More than 68% of the research funds went to investigations related to infections, central nervous system, neoplasms, and the heart.
- Cardiovascular product research led with 23% of the total in 1989.
- Research expenditures abroad are most often directed to cardiovascular products. Research on anti-infectives, neoplasms, and central nervous system also receive large shares of total expenditures.

Tables 20 and 21

U.S. R&D Expenditures for Pharmaceuticals, by Product Class, 1988, 1989 (percentages) 20

Product Class	1988	1989
Anti-infectives	13.9%	15.0%
Central Nervous System and Sense Organs	14.6	15.4
Cardiovasculars	25.1	23.0
Neoplasms, Endocrine System and Metabolic Diseases	18.5	15.2
Gastrointestinal and Genitourinary System	4.1	4.6
Respiratory	5.4	6.1
Biologicals	4.1	4.7
Dermatologicals	2.1	2.3
Vitamins	.2	.2
Diagnostic (in vivo)	.7	2.0
Other	7.8	8.0
Veterinary Preparations	3.2	3.3
Veterinary Biologicals	.3	.2
TOTAL	100.0%	100.0%

R&D Expenditures Abroad for Pharmaceuticals, by Product Class, 1988, 1989 (percentages)

21

Product Class	1988	1989
Anti-infectives	12.9%	17.3%
Cardiovasculars	21.1	25.4
Central Nervous System and Sense Organs	13.8	14.9
Gastrointestinal and Genitourinary System	7.9	6.4
Neoplasms, Endocrine System and Metabolic Diseases	15.3	15.5
Respiratory	5.9	4.9
Dermatologicals	2.1	1.4
Biologicals	2.9	2.5
Vitamins	.6	0.0
Diagnostic (in vivo)	.1	.2
Other	13.5	7.7
Veterinary Preparations	3.7	3.5
Veterinary Biologicals	0.2	0.3
TOTAL	100.0%	100.0%

R&D Expenditures for Ethical Pharmaceuticals: 1988, 1989 (actual), 1990 (budgeted), and 1991 (projected) PMA Member Firms (millions of dollars)

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	1988 Actual	1989 Actual	1990 Budgeted	1991 Projected
Company-Financed R&D Expenditures for Human Use Pharms.:				
Amount spent in the United States	$5,050.9	$5,824.0	$6,446.2	$7,277.0
Within Firm	4,027.1	4,628.9	5,111.8	
Outside Firm	1,023.8	1,195.1	1,334.4	
Amount spent in foreign countries	$1,260.9	$1,260.9	$1,432.3	$1,631.0
Within Firm	1,019.3	984.0	1,109.3	
Outside Firm	241.6	276.9	323.0	
TOTAL Human-Use R&D	$6,311.8	$7,084.9	$7,878.5	$8,908.0
Company-Financed R&D Expenditures for Veterinary Use Pharms.:				
Amount spent in United States	$ 177.8	$ 195.3	$ 196.7	$ 225.0
Within firm	161.9	170.7	169.9	
Outside firm	15.9	24.6	26.8	
Amount spent in foreign countries	$ 42.7	$ 47.7	$ 54.0	$ 60.3
Within firm	37.3	39.0	46.9	
Outside firm	5.4	8.7	7.1	
TOTAL Veterinary R&D	$ 220.5	$ 243.0	$ 250.7	$ 285.3
TOTAL Company-Financed R&D for Pharmaceuticals	$6,532.3	$7,327.9	$8,129.2	$9,193.3
U.S. Government Grants and Contracts for Company-Conducted Pharmaceutical R&D	5.2	2.1	2.9	3.0
TOTAL Expenditures for Pharmaceutical R&D	$6,537.5	$7,330.0	$8,132.1	$9,196.3

R&D Expenditures for Ethical Pharmaceuticals (millions of dollars) 1989 (actual) 1990 (budgeted), 1991 (projected)

14

	1989		1990		1991	
	Amount	Change 1988–89	Amount	Change 1989–90	Amount	Change 1990–91
Company-Financed, for Human-Use Pharmaceuticals:						
Amount spent in U.S.	$5,824.0	+15.3%	$6,446.2	+10.7%	$7,277.0	+12.9%
Amount spent in foreign countries	1,260.9	0	1,432.3	+13.6%	1,631.0	+13.9%
Company-Financed, for Veterinary-Use Pharmaceuticals:						
Amount spent in U.S.	$195.3	+9.8%	$196.7	+.7%	$225.0	+14.4%
Amount spent in foreign countries	47.7	+11.7%	54.0	+13.2%	60.3	+11.7%

Domestic and Foreign Shares of Company-Funded R&D Expenditures 1984–90 (percentages)

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	1984	1985	1986	1987	1988	1989	1990*
R&D Expenditures, Human-and-Animal—Use Pharmaceuticals							
Domestic	83.0	83.0	82.0	82.0	81.0	82.0	82.0
Foreign	17.0	17.0	18.0	18.0	19.0	18.0	18.0
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*1990 figures are budgeted or estimated.

R&D Expenditures for Ethical Pharmaceuticals, Allocation of Funds (percentages) 1988, 1989 (actual), 1990 (budgeted) and 1991 (projected)

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Category of R&D Expenditures for Ethical Pharmaceuticals	1988	1989	1990 (Budgeted)	1991 (Projected)
Company-Financed R&D Expenditures for Human-Use Products:				
Percentage spent in the United States	77.26%	79.45%	79.27%	79.13%
Within firm	61.60	63.15	62.86	
Outside firm	15.66	16.30	16.41	
Percentage spent in foreign countries	19.29%	17.20%	17.61%	17.74%
Within firm	15.59	13.42	13.64	
Outside firm	3.70	3.78	3.97	
TOTAL Human-use R&D	96.55%	96.65%	96.88%	96.87%
Company-Financed R&D Expenditures for Veterinary-Use Products:				
Percentage spent in the United States	2.72%	2.67%	2.42%	2.44%
Within firm	2.48	2.33	2.09	
Outside firm	.24	.34	.33	
Percentage spent in foreign countries	.65%	.65%	.66%	.66%
Within firm	.57	.53	.58	
Outside firm	.08	.12	.08	
TOTAL Veterinary R&D	3.37%	3.32%	3.08%	3.10%
TOTAL Company-Financed R&D	99.92	99.97	99.96	99.97
U.S. Government Grants and Contracts for Company-Conducted R&D	.08	.03	.04	.03
TOTAL Expenditures for R&D	100.00%	100.00%	100.00%	100.00%

Research and Development
Allocation of Expenditures by Function

- About half of all R&D expenditures is allocated to Biological Screening and Pharmacological Testing, Clinical Evaluation, and Synthesis and Extraction.

- The largest share, 27%, is spent on Clinical Evaluation: Phases I, II, and III.

Distribution of U.S. R&D Expenditures for Ethical Pharmaceuticals by Function

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Function	Percentage of Total 1988	1989
Clinical Evaluation: Phases I, II, III	26.4%	26.7%
Biological Screening and Pharmacological Testing	16.7	16.9
Synthesis and Extraction	10.3	9.8
Pharmaceutical Dosage Formulation and Stability Testing	9.1	9.4
Toxicology and Safety Testing	7.8	7.0
Process Development for Manufacturing and Quality Control	9.1	7.3
Clinical Evaluation: Phase IV	3.5	4.0
Regulatory, IND and NDA Preparation, Submission and Processing	3.0	3.3
Bioavailability Studies	2.8	2.6
Other	11.3	13.0
TOTAL	100.0%	100.0%

1987–1989 Research and Development Employment

- R&D employment in PMA member firms totalled 54,080 in 1989, 81% of this total in the U.S. This total represents a 5% increase over 1988.
- The average R&D expenditure per R&D employee in the U.S. was $110,032 in 1989, 13% higher than the figure for 1988.
- Firms investing over $100 million in R&D employed about two thirds of the total R&D personnel in the U.S.

Tables 23, 24, 25 and 26

R&D Personnel in the United States, by Position Level

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Category	1987	1988	1989
Scientific and Professional	26,890	27,230	28,610
Technical	6,260	6,320	6,640
Supporting Staff	7,760	7,970	8,370
Total	40,910	41,520	43,620

R&D Personnel in U.S. and Abroad, 1985-1989

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Year	Grand Total	U.S.	Abroad
1985	44,700	35,800	8,900
	(100%)	(80%)	(20%)
1986	47,770	38,270	9,500
	(100%)	(80%)	(20%)
1987	50,610	40,910	9,700
	(100%)	(81%)	(19%)
1988	51,400	41,520	9,880
	(100%)	(81%)	(19%)
1989	54,080	43,620	10,460
	(100%)	(81%)	(19%)

Research and Development/Sales Ratio

- The percentage of the domestic pharmaceutical sales dollar allocated to domestic R&D was 16.5% in 1989. For 1990 the estimated percentage is 16.5% and the projected ratio for 1991 is 16.9%.

R&D as a Percentage of Sales, Ethical Pharmaceuticals 27

Year	1985	1986	1987	1988	1989	1990*	1991**	Average 1985–1991
Ratio	14.8	14.8	15.8	16.3	16.5	16.5	16.9	15.9

Human and veterinary ethical pharmaceuticals. R&D is domestic U.S. only as financed by companies for internal and external performance. Sales basis: Domestic sales plus exports to other firms and intrafirm exports but excluding sales of foreign plants owned by U.S. firms. Data represent all PMA member firms.

*Estimated or Budgeted
**Projected

Glossary

Definitions used in the 1989–1991 Survey

Biologicals—bacterial and virus vaccine, antigens, antitoxins, toxoids, and analogous products (such as allergenic extracts), serums, plasmas, and other blood derivatives for human use.

Bulk—For use as a pharmaceutical or medicinal product in further manufacture or in packaging by another company, or for processing in animal feeds (but not as nutritional ingredients), or in prescription compounding, etc.

Company or Firm—Manufacturers including parent, affiliated and subsidiary companies, without duplication engaged in production of ethical pharmaceuticals, biologicals, and diagnostic products.

Diagnostic Agents (in vivo)—Diagnostic products used in living body.

Employment—All full-time production workers as well as officers of the company, including employees engaged in the following activities: factory supervision above the working foreman level, sales, advertising, financial, clerical, executive, purchasing, legal, personnel, professional and technical.

1. *Production Workers*—Employees up through the working foreman level engaged in fabricating, processing, assembling, receiving, inspection, quality control, handling, packing, warehousing and storage, shipping, maintenance, repair, janitorial, watchman service, production development, record keeping, and other services associated with the production operations.
2. *Medical Research and Development*—Personnel engaged in research, research administration, clinical evaluation and development; excludes personnel in promotion, sales, market research, business administration, production and quality control.
3. *Sales and Marketing Research Employees*—Personnel in sales, advertising, sales promotion, market research, etc.
4. *Administrative Employees*—Personnel responsible for general management, accounting, finance, planning, personnel, purchasing office services, legal secretarial, etc.
5. *Distribution*—Personnel responsible for distribution, including transportation and warehousing.

Employment Abroad—Total number of full-time employees, whether U.S. citizens or not, of PMA member firms or any wholly owned overseas corporation, or corporations in which PMA member firms had a substantial or controlling interest.

Ethical Pharmaceuticals—Products, including biological and medicinal chemicals, used for the cure, alleviation, mitigation, treatment, prevention or diagnosis of disease in humans or animals and promoted primarily to the medical, pharmacy and allied professions; includes products for over-the-counter ethical sales as well as for ultimate dispensing by prescription only.

Exports—"f.o.b.," U.S. port.

a) To other firms: sales to third parties only.

b) Intrafirm transactions: sales and shipments at billed (and end sales) value to subsidiaries and affiliates for further handling, processing or packaging.

Governmental Grants and Contracts for Company-Conducted R&D—Grants and contractual payments received by companies from governmental agencies for pharmaceutical research and development.

Over-The-Counter Ethical—A drug product sold over the counter but primarily promoted to the professions. This does not include proprietary drugs (i.e., OTC products on display for purchase by consumers).

Prescription Legend—A drug product which by Federal law is available only by prescription from a licensed physician.

Research and Development—The term includes basic and applied research as well as development activities carried on or supported in the pharmaceutical, biological, chemical, medical and related sciences, including psychology and psychiatry, if the purpose of such activities is concerned ultimately with the utilization of scientific principles in understanding diseases or in improving health.

R&D Expenditures—The total cost incurred for all pharmaceutical research and development activity, including cost of salaries, other direct costs, service, routine supplies, and supporting costs, plus a fair share of overhead (administration, depreciation, space charges, rent, etc.).

Costs of drugs or medical research and development conducted on grant or contract for other companies are excluded. Conversely, total outlays for all research and development work contracted to others (manufacturers, independent research laboratories, academic institutions, etc.) are included.

Research and Development Expenditures Within Firm—Includes research and development expenditures in the United States and foreign countries in the firm's own research laboratories.

Research and Development Expenditures Outside Firm—Research and development funds contracted or granted to such organizations as commercial laboratories, private practitioners, consultants, etc., educational institutions, non-profit research institutions, manufacturing and other companies or other research performing organizations.

R&D Manpower—Personnel engaged in research, research administration, clinical evaluation and development: excludes personnel in promotion, sales, market research, business administration, production and qualilty control.

Research and Development Scientific and Professional Staff—Includes all persons whose work requires the application for research and development of knowledge, skills and scientific techniques, in the life, physical, engineering, or mathematical sciences, acquired through the completion of a four-year college course (or its equivalent) with a major in these fields or in medicine or other health professions. Excludes persons who have formal training in the sciences but who are not actively engaged in research and development.

Research and Development Support Staff—Includes persons who provide literature, clinical, statistical, or other services specifically for R&D staff and technicians.

Research and Development Technicians—Includes persons actually engaged in technical work at a level which requires knowledge of the life, physical engineering, or mathematical sciences comparable at least to that acquired through technical institutes, junior colleges, or other formal post-high school training less extensive that four-year college training, or through equivalent on-the-job training or experience. However, also included are persons who hold an academic degree at the bachelor's level or above.

Sales—Sales figures are reported as billed (before deducting cash discounts on sales and other marketing expense), less returns and allowances. Includes sales value of products bought and resold without further processing or repacking as well as the dollar value of products made from own materials for other manufacturers' resale. Excluded are all royalty payments, interest and other income.

Sales Abroad—Actual sales consummated in foreign countries other than "Sales for Exports or Other Firms." Such sales by affiliates and subsidiaries or other operations abroad are reported in dollars, computed at December 31 rate of exchange (when possible) for the year shown. Where a partially owned subsidiary is involved, the firm's share is determined on a proportionate profit-sharing basis.

Sales for Export—Reported as "f.o.b. U.S. port."

1. *To Other Firms*—Excludes intracompany transactions, includes sales to third parties only.
2. *Intracompany Transactions*—Includes sales and shipments to subsidiaries or affiliates for further handling, processing, or finishing by them. Reported as net billed value, not end sales values.

Sales by Product Class—Estimated distribution of domestic sales of ethical pharmaceutical and biological dosage-form preparations in accordance with the classification system used in the annual Current Industrial Reports from the Bureau of the Census.

Sales to Governments—Sales or shipments made directly to federal, state or local government agencies, hospitals and clinics.

Sales to Private Sector—Sales through regular marketing channels for end-use other than by government agency administration or distribution.

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U.S. Intramural R&D Expenditures for Human and Veterinary Use Pharmaceuticals per R&D Employee, 1989

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Annual R&D Expenditure	Average Expenditure Per R&D Employee 1989
Over $200 million	$ 71,191
$100-$200 million	65,176
Under $100 million	121,993
Average, All Firms	110,032

R&D Employment by Company R&D Expenditures, 1989

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Annual R&D Expenditures	Total	Scientific & Professional	Technicians	Supporting	Scientists per 100 Employees
Over $200 million	25,250	16,760	3,680	4,810	67
$100-200 million	13,410	8,860	1,950	2,600	58
Under $100 million	4,960	2,990	1,010	960	84
Total:	43,620	28,610	6,640	8,370	66